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Scientific, Technical and Economic Committee for Fisheries (STECF)

Monitoring the performance of the Common Fisheries Policy (STECF-15-04)

Edited by Norman Graham, John Casey and Hendrik Doerner

This report was reviewed by the STECF by written procedure in March 2015

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Institute for the Protection and Security of the Citizen (IPSC)

Contact information
STECF secretariat
Address: Maritime Affairs Unit, Via Enrico Fermi 2749, 21027 Ispra VA, Italy
E-mail: stecf-secretariat@jrc.ec.europa.eu
Tel.: 0039 0332 789343
Fax: 0039 0332 789658

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Abstract

An ad hoc Expert Group on 'Monitoring the performance of the Common Fisheries Policy' composed of JRC experts was held on 10-11th February 2015 at JRC, Ispra, Italy. The ad hoc report was finalized and subsequently reviewed by the STECF by written procedure in March 2015.

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MONITORING THE PERFORMANCE OF THE COMMON FISHERIES POLICY (STECF-15-04)

The STECF review and adoption of the report of the ad hoc Expert group to monitor the performance of the Common Fisheries Policy was undertaken during March 2015.

BACKGROUND

Article 50 of the Common Fisheries Policy (CFP; Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013) stipulates:

"The Commission shall report annually to the European Parliament and to the Council on the progress on achieving maximum sustainable yield and on the situation of fish stocks, as early as possible following the adoption of the yearly Council Regulation fixing the fishing opportunities available in Union waters and, in certain non-Union waters, to Union vessels."

To facilitate such a report, in October 2014, the Commission requested the STECF to review and advise on suitable metrics and indicators. Based on the STECF Report (STECF 14-23), the Commission requested that an ad hoc Expert Group be convened to address the following Terms of Reference and prepare a report for review by the STECF.

TERMS OF REFERENCE

1. Determine, on the basis of the most recent available fish stock assessments, a list of fish stocks for monitoring the past performance of the Common Fisheries Policy according to the following criteria:
    a. Quantitative assessments as used in the provision of formal quantitative advice on fishing mortality with respect to Fmsy.
    b. Stocks in European Union waters, shared stocks which are jointly managed by the EU with nearby states, and stocks in international waters or third country waters that are fished by the EU and managed by an RFMO where the EU is a member of the decision making body.
2. For stocks within the sampling frame defined above, calculate the following **annual** quantities as far back in time as the data remain representative.
    a. Number of stocks where fishing mortality exceeds Fmsy
    b. Number of stocks where fishing mortality is equal to or less than Fmsy

c. Number of stocks outside safe biological limits
d. Number of stocks inside safe biological limits
e. Number of stocks for which the state of the stock is unknown with respect to safe biological limits
f. The arithmetic average value of F/Fmsy

For the purposes of this term of reference, "outside safe biological limits" means that SSB is less than Bpa (where Bpa is defined), OR F is greater than Fpa (where Fpa is defined) for the year in question.

Estimates should be provided separately for the Baltic Sea, the North Sea, Western Waters, for each area covered by RFMOs other than NEAFC. Parameter f should also be reported for the combined area of the Baltic Sea, North Sea and Western Waters. The list of stocks should be provided together with a mention of whether the stock is fished above or below Fmsy.

3. For the purpose of assessing changes over time in the coverage of advice on TACs with respect to scientific advice concerning the northeast Atlantic:
   a. define a sampling frame based on a large subset of TACs of EU interest that is stable over time;
   b. assess the number and proportion of those TACs that are subject to scientific advice concerning:
      i. the fishing mortality compared to Fmsy;
      ii. the state with respect to safe biological limits, as defined above.

For the purposes of this exercise, a group of TACs covering one biological stock should be counted once only. For a TAC which covers several stocks, the biological state of the most abundant stock (by comparison with other stocks over an extended and representative period) should be taken into account.

The Commission services will provide STECF with an initial analysis for the purposes of the assessment under point 3.

STECF RESPONSE

STECF reviewed the Report of the ad hoc Expert group noting that each of the elements of the terms of Reference to the STECF has been adequately and appropriately addressed. STECF notes that in its Report, the ad hoc Expert Group has provided source code in 'R' which will make future reporting on the performance of the CFP semi-automatic. The Report is logically presented and the data and STECF concludes that all of the data and information presented in the report can be used by the Commission as a basis to fulfil its obligations under Article 50 of the Common Fisheries Policy (Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013) for stocks in the ICES area, for which the EU fixes fishing opportunities.

CONTACT DETAILS OF STECF MEMBERS AND ADHOC EXPERT GROUP

1 - Information on STECF members and invited experts' affiliations is displayed for information only. In some instances the details given below for STECF members may differ from that provided in Commission COMMISSION DECISION of 27 October 2010 on the appointment of members of the STECF (2010/C 292/04) as some members' employment details may have changed or have been subject to organisational changes in their main place of employment. In any case, as outlined in Article 13 of the Commission Decision (2005/629/EU and 2010/74/EU) on STECF, Members of the STECF, invited experts, and JRC experts shall act independently of Member States or stakeholders. In the context of the STECF work, the committee members and other experts do not represent the institutions/bodies they are affiliated to in their daily jobs. STECF members and invited experts make declarations of commitment (yearly for STECF members) to act independently in the public interest of the European Union. STECF members and experts also declare at each meeting of the STECF and of its Expert Working Groups any specific interest which might be considered prejudicial to their independence in relation to specific items on the agenda. These declarations are displayed on the public meeting's website if experts explicitly authorized the JRC to do so in accordance with EU legislation on the protection of personnel data. For more information: http://stecf.jrc.ec.europa.eu/adm-declarations

STECF members:

Name	Address[1]	Tel.	Email
STECF members			
Abella, J. Alvaro (vice-chair)	ARPAT – AREA MARE Agenzia Regionale per la Protezione Ambientale della Toscana Articolazione Funzionale RIBM Risorse Ittiche e Biodiversità Marina Via Marradi 114, 57126 Livorno – Italia	Tel. 0039-0555-3206956	alvarojuan.abella@arpat.toscana.it
Andersen, Jesper Levring (vice-chair)	Department of Food and Resource Economics (IFRO) Section for Environment and Natural Resources University of Copenhagen Rolighedsvej 25 1958 Frederiksberg Denmark	Tel.dir.: +45 35 28 68 92	jla@ifro.ku.dk
Bailey, Nicholas	Fisheries Research Services Marine Laboratory, P.O Box 101 375 Victoria Road, Torry Aberdeen AB11 9DB UK	Tel: +44 (0)1224 876544 Direct: +44 (0)1224 295398 Fax: +44 (0)1224 295511	baileyn@marlab.ac.uk n.bailey@marlab.ac.uk
Bertignac, Michel	Laboratoire de Biologie Halieutique IFREMER Centre de Brest BP 70 - 29280 Plouzane, France	tel : +33 (0)2 98 22 45 25 - fax : +33 (0)2 98 22 46 53	michel.bertignac@ifremer.fr
Cardinale, Massimiliano	Föreningsgatan 45, 330 Lysekil, Sweden	Tel: +46 523 18750	massimiliano.cardinale@slu.se

Name	Address[1]	Tel.	Email
STECF members			
Curtis, Hazel	Sea Fish Industry Authority 18 Logie Mill Logie Green Road Edinburgh EH7 4HS	Tel: +44 (0)131 558 3331 Fax: +44 (0)131 558 1442	H_Curtis@seafish.co.uk
Delaney, Alyne	Innovative Fisheries Management, -an Aalborg University Research Centre, Postboks 104, 9850 Hirtshals, Denmark	Tel.: +45 9940 3694	ad@ifm.aau.dk
Daskalov, Georgi	Laboratory of Marine Ecology, Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Tel.: +359 52 646892	gmdaskalov@yahoo.co.uk
Döring, Ralf	Thünen Bundesforschungsinstitut, für Ländliche Räume, Wald und Fischerei, Institut für Seefischerei - AG Fischereiökonomie, Palmaille 9, D-22767 Hamburg, Germany	Tel.: 040 38905-185 Fax.: 040 38905-263	ralf.doering@ti.bund.de
Gascuel, Didier	AGROCAMPUS OUEST 65 Route de Saint Brieuc, bat.4 CS 84215, F-35042 RENNES Cedex France	Tel:+33(0)2.23.48.55.34 Fax: +33(0)2.23.48.55.35	Didier.Gascuel@agrocampus-ouest.fr
Graham, Norman (chair)	Marine Institute, Fisheries Science Services (FSS), Rinville, Oranmore, Co. Galway, Ireland	Tel: + 353(0) 91 87200	norman.graham@marine.ie
Garcia Rodriguez, Mariano	Instituto Español de Oceanografía, Servicios Centrales, Corazón de María 8, 28002, Madrid, Spain		Mariano.Garcia@md.ieo.es
Gustavsson, Tore Karl-Erik	Independent Consultant, Göteborg, Sweden		tore.gustavsson@hotmail.com
Jennings, Simon	CEFAS Lowestoft Laboratory, Pakefield Road, Lowestoft Suffolk, UK NR33 0HT	Tel.: +44 1502562244 Fax: +44 1502513865	simon.jennings@cefas.co.uk
Kenny, Andrew	CEFAS Lowestoft Laboratory, Pakefield Road, Lowestoft Suffolk, UK NR33 0HT	Tel.: +44 1502562244 Fax: +44 1502513865	andrew.kenny@cefas.co.uk
Kraak, Sarah	University College Cork Based at: Marine Institute, Rinville, Oranmore, Co Galway, Ireland	Tel: +353 (0)91 387392 Fax +353 (0)91 387201	Sarah.kraak@marine.ie
Kuikka, Sakari	University of Helsinki, Department of Environmental Sciences, P.O. Box 65 (Viikinkaari 1), FI-00014 University of Helsinki, FINLAND	Tel.: +358 50 3309233 Fax. +358-9-191 58754	skuikka@mappi.helsinki.fi

Name	Address[1]	Tel.	Email
STECF members			
Martin, Paloma	CSIC Instituto de Ciencias del Mar PasseigMarítim, 37-49 08003 Barcelona Spain	Tel: 34.93.2309500 direct line : 34.93.2309552 Fax: 34.93.2309555	paloma@icm.csic.es
Malvarosa, Loretta	NISEA S.c.a.r.l.		malvarosa@nisea.eu
Murua, Hilario	AZTI - Tecnalia / Unidad de Investigación Marina, Herrera kaia portualdea z/g 20110 Pasaia (Gipuzkoa), Spain	Tel: 0034 667174433 Fax: 94 6572555	hmurua@azti.es
Nord, Jenny	The Swedish Agency of Marine and Water Management (SwAM)	Tel. 0046 76 140 140 3	Jenny.nord@havochvatten.se
Nowakowski, Piotr	Maritime University of Szczecin. – Faculty of Food Science and Fisheries, Department of Fishing Technique, Szczecin		npfgd@poczta.onet.pl
Prelezzo, Raul	AZTI - Tecnalia / Unidad de Investigación Marina Txatxarramendi Ugartea z/g 48395 Sukarrieta (Bizkaia), Spain	Tel: 94 6029400 Ext: 406- Fax: 94 6870006	rprellezo@suk.azti.es
Sala, Antonello	Fishing Technology Unit National Research Council (CNR) Institute of Marine Sciences (ISMAR) - Fisheries Section Largo Fiera della Pesca, 1 60125 Ancona - Italy	Tel: +39 071 2078841 Fax: +39 071 55313	a.sala@ismar.cnr.it
Scarcella, Giuseppe	Environmental Management Unit National Research Council (CNR) Institute of Marine Sciences (ISMAR) - Fisheries Section Largo Fiera della Pesca, 1 60125 Ancona - ITaly	Tel: +39 071 2078846 Fax: +39 071 55313	g.scarcella@ismar.cnr.it
Somarakis, Stylianos	Department of Biology University of Crete VassilikaVouton P.O. Box 2208 71409 Heraklion Crete Greece	Tel.: +30 2610 394065, +30 6936566764	somarak@biology.uoc.gr
Stransky, Christoph	Thünen Institute [TI-SF] Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Sea Fisheries, Palmaille 9, D-22767 Hamburg, Germany	Tel. +49 40 38905-228 Fax: +49 40 38905-263	christoph.stransky@ti.bund.de
Theret, Francois	Scapêche 17 Bd Abbé Le Cam 56100 Lorient France		ftheret@comata.com
Ulrich, Clara	DTU Aqua, National Institute of Aquatic Resources, Technical University of Denmark, Charlottenlund Slot, JægersborgAllé 1, 2920 Charlottenlund, Denmark		cu@aqua.dtu.dk

Name	Address[1]	Tel.	Email
STECF members			
Vanhee, Willy	ILVO - Institute for Agricultural and Fisheries Research Unit Animal Sciences - Fisheries Ankerstraat 1, B-8400 Oostende, Belgium	Tel 00-32-59-34-22-55 Fax 00-32-59-33-06-29	willy.vanhee@ilvo.vlaanderen.be
van Oostenbrugge, Hans	LandbouwEconomishInstituut-LEI, Fisheries Section, Burg. Patijnlaan 19 P.O.Box 29703 2502 LS The Hague The Netherlands	Tel:+31 (0)70 3358239 Fax: +31 (0)70 3615624	Hans.vanOostenbrugge@wur.Nl

Adhoc Expert Group participants

JRC experts			
Casey, John	European Commission, Joint Research Centre (IPSC), Maritime Affairs Unit Via E. Fermi, 2749 21027 Ispra (VA), Italy	(39) 0332 783936	john.casey@jrc.ec.europa.eu
Jardim, Ernesto	European Commission, Joint Research Centre (IPSC), Maritime Affairs Unit Via E. Fermi, 2749 21027 Ispra (VA), Italy	(39) 0332 785311	ernesto.jardim@jrc.ec.europa.eu
Mosqueira, Iago	European Commission, Joint Research Centre (IPSC), Maritime Affairs Unit Via E. Fermi, 2749 21027 Ispra (VA), Italy	(39) 0332 785413	iago.mosqueira-sanchez@jrc.ec.europa.eu
Osio, Giacomo Chato	European Commission, Joint Research Centre (IPSC), Maritime Affairs Unit Via E. Fermi, 2749 21027 Ispra (VA), Italy	(39) 0332 785948	giacomo-chato.osio@jrc.ec.europa.eu
Scott, Finlay	European Commission, Joint Research Centre (IPSC), Maritime Affairs Unit Via E. Fermi, 2749 21027 Ispra (VA), Italy	(39) 0332 789610	finlay.scott@jrc.ec.europa.eu

REPORT TO THE STECF

AD HOC EXPERT GROUP on Monitoring the Performance of the Common Fisheries Policy

Ispra, Italy, 10-11 February 2015

Report of the ad hoc Expert Group on monitoring the performance of the Common Fisheries policy

Iago Mosqueira, Ernesto Jardim, Finlay Scott, John Casey, Chato Osio

JRC Ispra (IT), 13 March, 2015

Following the recommendations of STECF EWG 14-20 on Reporting needs on fishery resources under new CFP, an ad-hoc working group has produced an analysis to generate the requested indices of performance for 2013. Calculations were carried out using publicly available datasets of stock assessment results, which at this point limits the scope to those stocks for which scientific advice is provided by ICES.

Contents

1 Terms of reference

1. Determine, on the basis of the most recent available fish stock assessments, a list of fish stocks for monitoring the past performance of the Common Fisheries Policy according to the following criteria:

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   b. Stocks in European Union waters, shared stocks which are jointly managed by the EU with nearby states, and stocks in international waters or third country waters that are fished by the EU and managed by an RFMO where the EU is a member of the decision making body.

2. For stocks within the sampling frame defined above, calculate the following **annual** quantities as far back in time as the data remain representative.

   a. Number of stocks where fishing mortality exceeds Fmsy [1]
   b. Number of stocks where fishing mortality is equal to or less than Fmsy [2]
   c. Number of stocks outside safe biological limits
   d. Number of stocks inside safe biological limits
   e. The arithmetic average value of F/Fmsy
   f. Number of stocks for which the state of the stock is unknown with respect to safe biological limits

   For the purposes of this term of reference, "outside safe biological limits" means that SSB is less than Bpa (where Bpa is defined), OR F is greater than Fpa (where Fpa is defined) for the year in question.
   Estimates should be provided separately for the Baltic Sea, the North Sea, Western Waters, for each area covered by RFMOs other than NEAFC. Parameter f should also be reported for the combined area of the Baltic Sea, North Sea and Western Waters. The list of stocks should be provided together with a mention of whether the stock is fished above or below Fmsy.

3. For the purpose of assessing changes over time in the coverage of advice on TACs with respect to scientific advice concerning the northeast Atlantic:

   a. define a sampling frame based on a large subset of TACs of EU interest that is stable over time;
   b. assess the number and proportion of those TACs that are subject to scientific advice concerning:
      i. the fishing mortality compared to Fmsy;
      ii. the state with respect to safe biological limits, as defined above.

   For the purposes of this exercise, a group of TACs covering one biological stock should be counted once only. For a TAC which covers several stocks, the biological state of the most abundant stock (by comparison with other stocks over an extended and representative period) should be taken into account.
   The Commission services will provide STECF with an initial analysis for the purposes of the assessment under point 3.

2 Participants

- **J. Casey**, European Commission, Joint Research Center, IPSC/Maritime Affairs Unit G03, Via E. Fermi 2749, 21027 Ispra VA, Italy
- **E. Jardim**, European Commission, Joint Research Center, IPSC/Maritime Affairs Unit G03, Via E. Fermi 2749, 21027 Ispra VA, Italy
- **I. Mosqueira**, European Commission, Joint Research Center, IPSC/Maritime Affairs Unit G03, Via E. Fermi 2749, 21027 Ispra VA, Italy

[1] Including, for short-lived species managed according to a biomass-escapement strategy, the number of stocks where the resulting biomass was less than the escapement biomass corresponding to MSY fishing.

[2] Including, for short-lived species managed according to a biomass-escapement strategy, the number of stocks where the resulting biomass was equal to or higher than the escapement biomass corresponding to MSY fishing.

- **C. Osio**, European Commission, Joint Research Center, IPSC/Maritime Affairs Unit G03, Via E. Fermi 2749, 21027 Ispra VA, Italy
- **F. Scott**, European Commission, Joint Research Center, IPSC/Maritime Affairs Unit G03, Via E. Fermi 2749, 21027 Ispra VA, Italy

2.1 Observers

- **K. Patterson**, European Commission, DG MARE A.

3 Data and methods

3.1 Data sources

Calculation of the various indicators could at this point only be carried out for the areas for which advice is being provided by ICES. For other areas, a dataset could not be compiled due to the non-availability of an organized publicly available dataset of stock assessment results.

3.1.1 ICES

Results of quantitative stock assessments, including the adopted fishing mortality and biomass reference points, carried out by ICES were retrieved from the relevant section of the ICES website on 23 February 2015. Stock assessment results for *Nephrops* stocks, not currently included in that dataset, were provided in a similar format by ICES. Data for the IVa-VIa stock of Megrim were extracted from the relevant ICES report http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/2014/meg-4a6a.pdf. These were not present in the ICES dataset as the assessment was carried out in 2013, but it was then subsequently used to provide advice in 2014.

This dataset was complemented with a list of the ecoregion each stock falls into, provided directly by ICES (see Appendix B). Stocks "of interest to the EU" were selected from this dataset.

The final dataset compiled included 96 stocks.

3.2 Methods

Data was transformed, plotted and analysed using the R statistical language, version 3.1.2 (R Core Team 2014). Source code for the complete analysis is available in Appendix A.

4 Findings in relation to each of the items in the Terms of Reference

4.1 ToR 1: Determination of the sampling frame

The sampling frame determined under this ToR will be used for the computation of the indicators requested under ToR 2. Using the most recent fish stock assessment reports provided by ICES, stocks were chosen for inclusion in the indicators if:

- an estimate of the ratio of F to F_{MSY} is available, which was interpreted as evidence that a quantitative stock assessment is available and had been accepted for the provision of formal quantitative advice to the European Commission with respect to F_{MSY}.

- the stock had been identified together with DG MARE as of *EU relevance* for the monitoring of the implementation of the CFP.

The number of stocks thus included varies along the time series depending on the starting point of the stock assessment. All included stock assessments, 63 in total, go back to 1999 at least (Figure 1).

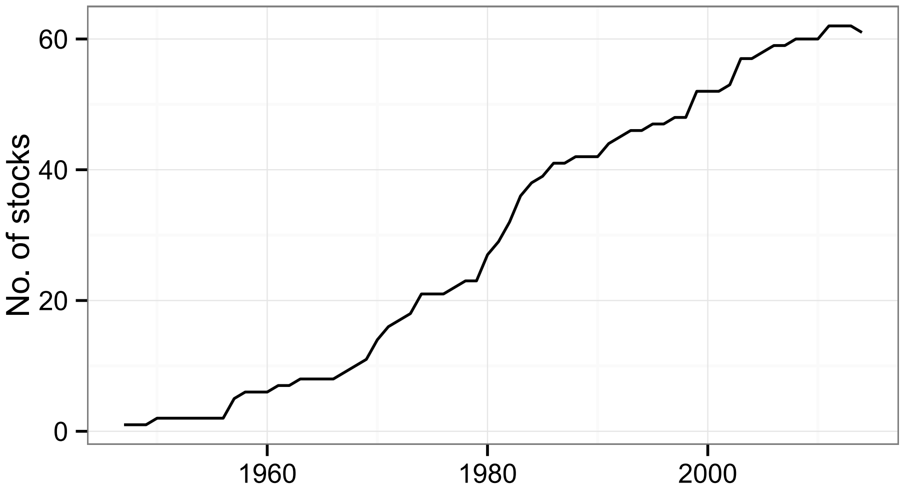

Figure 1: No. of stocks in the ICES area for which estimates of F/F_{MSY} are available by year, and considered relevant for the monitoring of the CFP performance.

4.2 ToR 2: Indicators of management performance

Estimates of relative stock status were only considered for the 2003 - 2013 period, as the first date marks the start of the previous CFP European Commission (2002) and the later is the last year for which abundance and fishing mortality estimates are available from the 2014 stock assessment dataset.

For ToRs 2a to 2d two plots, showing the time series for the whole ICES area and for the four regions, and a table with the exact counts for each region and for all combined, are presented.

4.2.1 ToR 2.a: Number of stocks where fishing mortality exceeds Fmsy

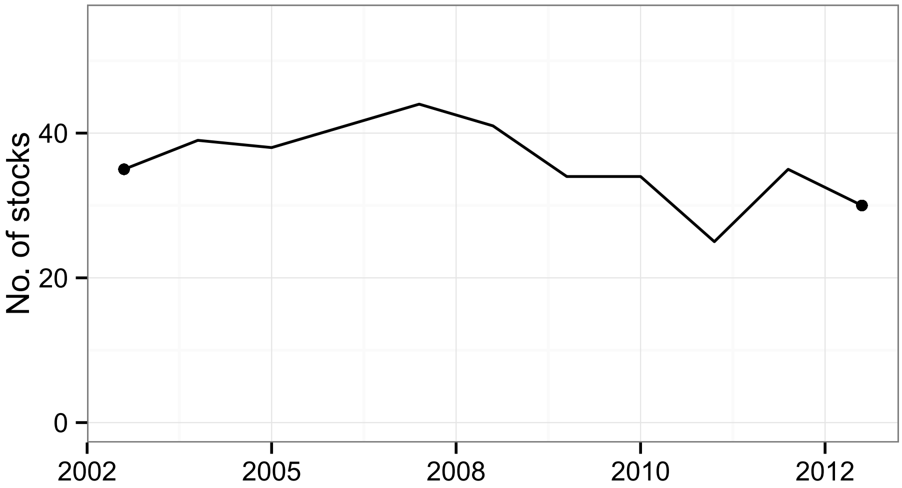

Figure 2: Number of stocks where fishing mortality (F) exceeds fishing mortality at MSY (F_{MSY}) by year.

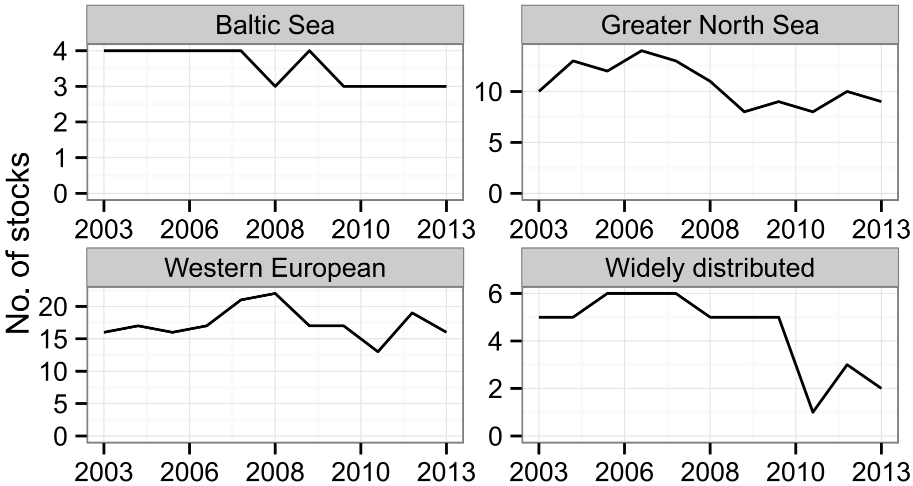

Figure 3: Number of stocks where fishing mortality (F) exceeds fishing mortality at MSY (F_{MSY}) by year.

Table 1: Number of stocks where fishing mortality (F) exceeds fishing mortality at MSY (F_{MSY}) by region.

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	35	39	38	41	44	41	34	34	25	35	30
Baltic Sea	4	4	4	4	4	3	4	3	3	3	3
Greater North Sea	10	13	12	14	13	11	8	9	8	10	9
Western European	16	17	16	17	21	22	17	17	13	19	16
Widely distributed	5	5	6	6	6	5	5	5	1	3	2

4.2.2 ToR 2.b: Number of stocks where fishing mortality is equal to or less than Fmsy

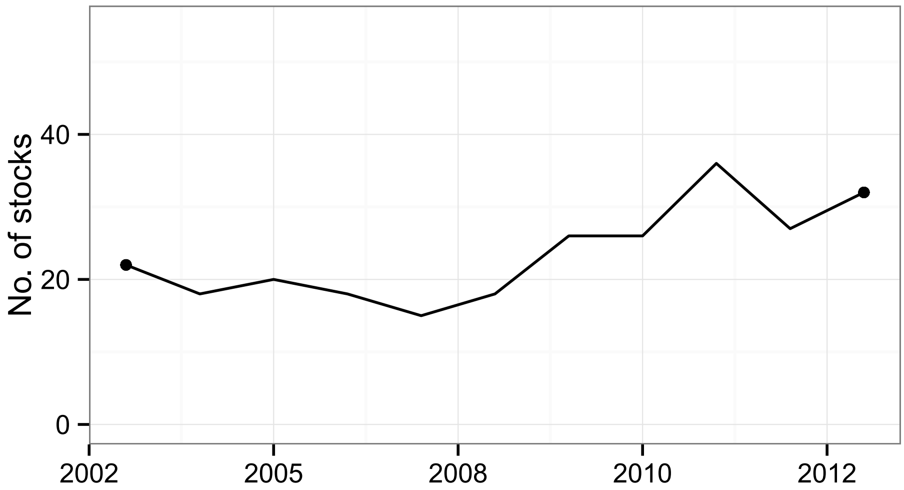

Figure 4: Number of stocks where fishing mortality (F) does not exceed fishing mortality at MSY (F_{MSY}) by year.

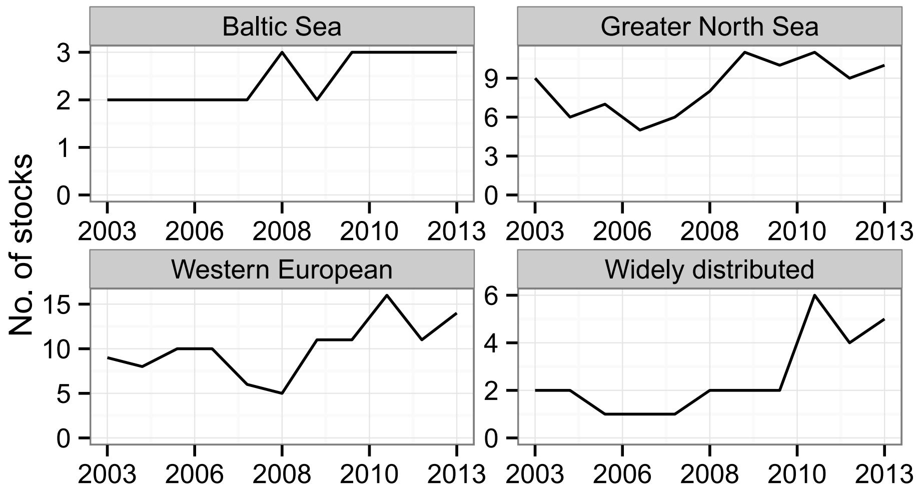

Figure 5: Number of stocks where fishing mortality (F) does not exceed fishing mortality at MSY (F_{MSY}) by year and region.

Table 2: Number of stocks where fishing mortality (F) does not exceed fishing mortality at MSY (F_{MSY}) by region.

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	22	18	20	18	15	18	26	26	36	27	32
Baltic Sea	2	2	2	2	2	3	2	3	3	3	3
Greater North Sea	9	6	7	5	6	8	11	10	11	9	10
Western European	9	8	10	10	6	5	11	11	16	11	14
Widely distributed	2	2	1	1	1	2	2	2	6	4	5

4.2.3 ToR 2.c: Number of stocks outside safe biological limits

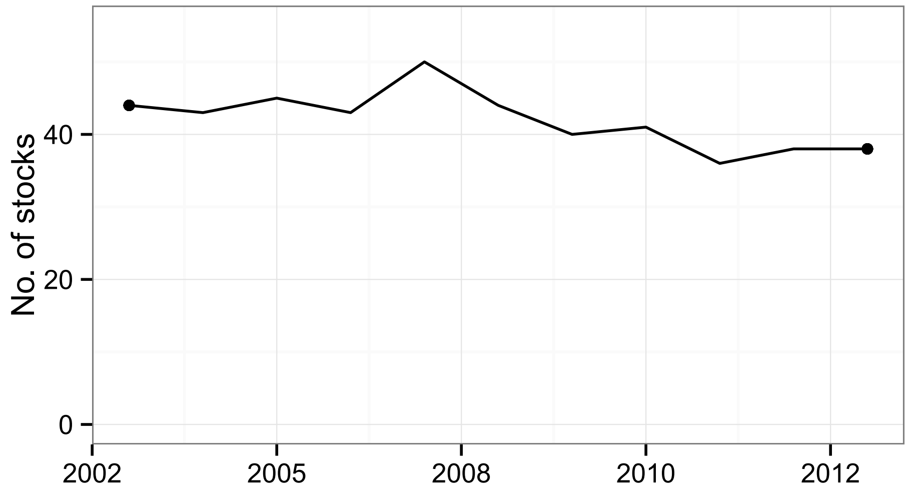

Figure 6: Number of stocks outside safe biological limits by year.

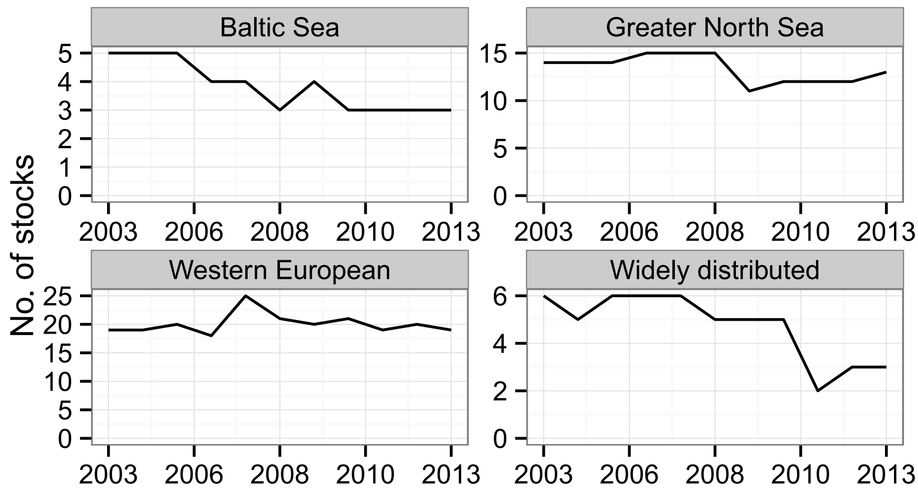

Figure 7: Number of stocks outside safe biological limits by year and region.

Table 3: Number of stocks outside safe biological limits by region and for the whole ICES area. Outside safe biological limits means that SSB is less than Bpa (where Bpa is defined), or F is greater than Fpa (where Fpa is defined).

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	44	43	45	43	50	44	40	41	36	38	38
Baltic Sea	5	5	5	4	4	3	4	3	3	3	3
Greater North Sea	14	14	14	15	15	15	11	12	12	12	13
Western European	19	19	20	18	25	21	20	21	19	20	19
Widely distributed	6	5	6	6	6	5	5	5	2	3	3

4.2.4 ToR 2.d: Number of stocks inside safe biological limits

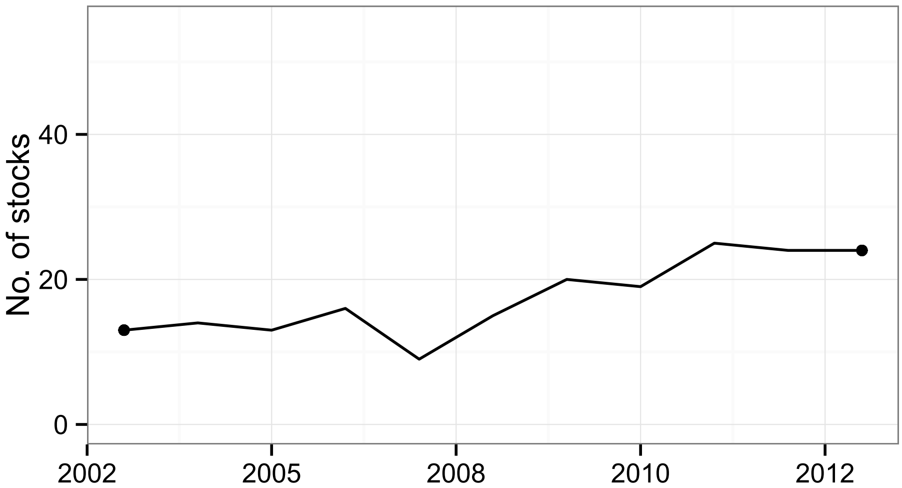

Figure 8: Number of stocks inside safe biological limits by year.

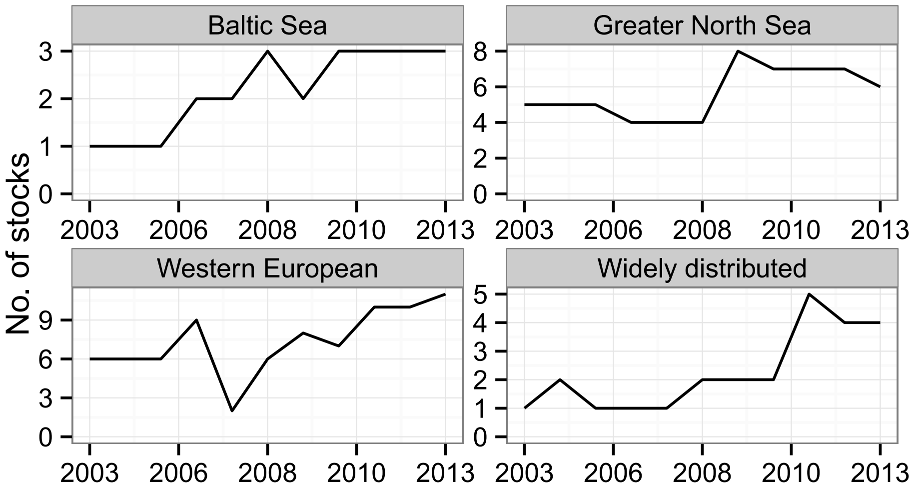

Figure 9: Number of stocks inside safe biological limits by year and region.

Table 4: Number of stocks inside safe biological limits by region and for the whole ICES area. Inside safe biological limits means that SSB is greater than Bpa (where Bpa is defined), or F is less than Fpa (where Fpa is defined).

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	13	14	13	16	9	15	20	19	25	24	24
Baltic Sea	1	1	1	2	2	3	2	3	3	3	3
Greater North Sea	5	5	5	4	4	4	8	7	7	7	6
Western European	6	6	6	9	2	6	8	7	10	10	11
Widely distributed	1	2	1	1	1	2	2	2	5	4	4

4.2.5 ToR 2.e: Arithmetic mean value of F/F_{MSY}

For this indicator only stocks not managed under escapement strategies were included. *Nephrops* stocks, for which fishing mortality was reported as a harvest rate, were also excluded, as values could not be directly combined. Harvest rate, defined as a proportion of the biomass (or numbers) being caught, has a non-linear relationship with fishing mortality, defined as an instantaneous rate, so should not combined linearly.

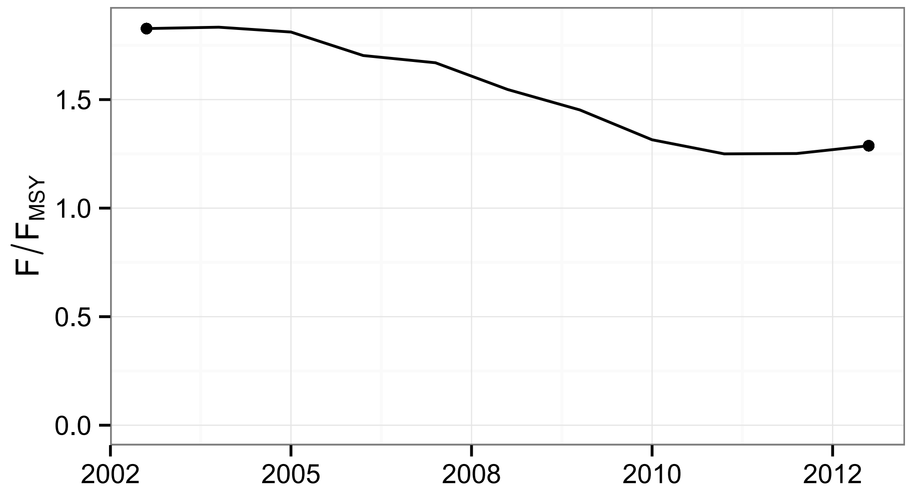

Figure 10: Arithmetic mean value of the F/F_{MSY} ratio by year.

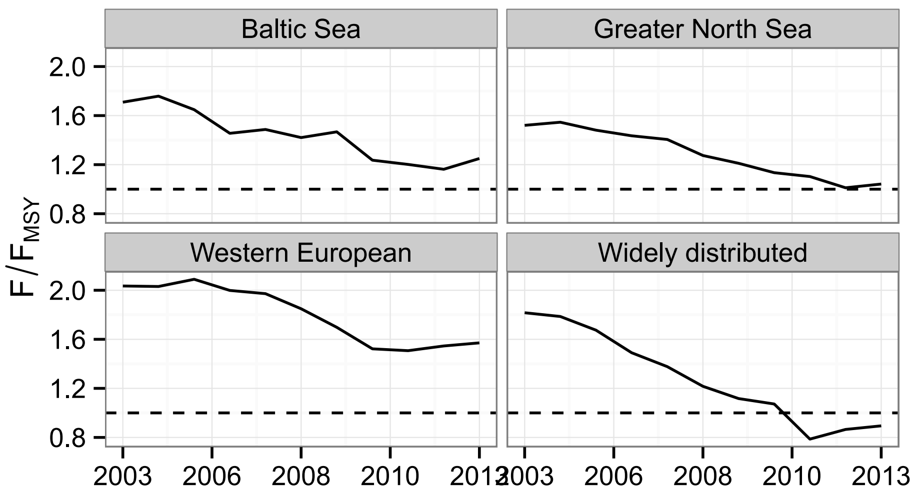

Figure 11: Arithmetic mean value of the F/F_{MSY} ratio by year and region.

Table 5: Arithmetic mean value of the F/F_{MSY} ratio by year and region.

Region	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
All	1.83	1.83	1.81	1.70	1.67	1.55	1.45	1.31	1.25	1.25	1.29
Baltic Sea	1.71	1.76	1.65	1.46	1.49	1.42	1.47	1.24	1.20	1.16	1.25
Greater North Sea	1.52	1.55	1.48	1.44	1.41	1.27	1.21	1.13	1.10	1.01	1.04
Western European	2.03	2.03	2.09	2.00	1.97	1.85	1.70	1.52	1.51	1.55	1.57
Widely distributed	1.82	1.79	1.67	1.49	1.38	1.22	1.12	1.07	0.79	0.87	0.89

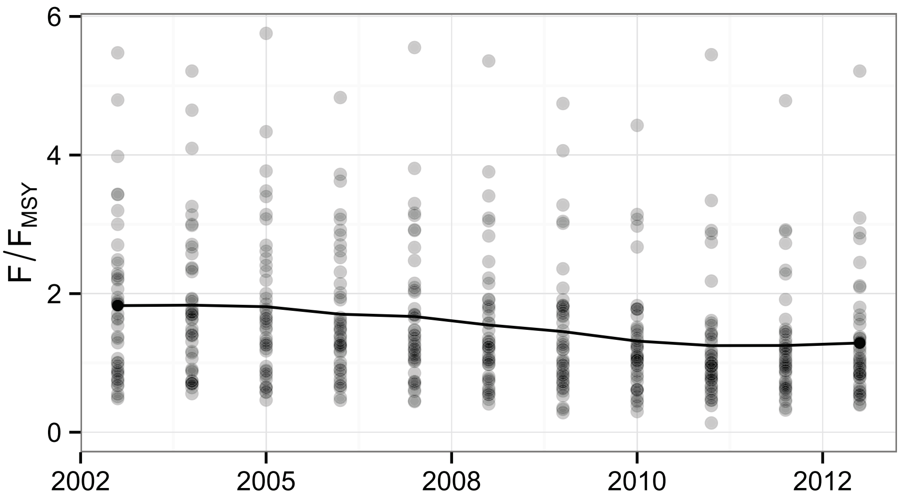

Figure 12: Scatterplot of F/F_{MSY} values and arithmetic mean by year.

4.2.6 ToR 2.f: Number of stocks for which the state of the stock is unknown with respect to safe biological limits

At this point this indicator could not be calculated as the initial sampling frame is already limited to stocks for which quantitative advice is available. The status of the stock with respect to biomass levels is thus also known.

4.3 ToR 3: Indicators of changes in advice coverage

The sampling frame for this indicator was provided by MARE by selecting a subset of stocks comparable to those used in the calculation of CFP performance in previous years. This analysis is only computed on the current ICES dataset, which does not reflect the advice given in previous years. For example, if a stock was newly assessed in 2014, with data going back to 1999, the indicator computed from this dataset will be updated for the whole 1999-2013 period. A complete calculation of the advice coverage indicator would require the corresponding stock assessment dataset for previous years, which was outside the scope of this analysis.

Table 6: Number of stocks for which estimates exist of fishing mortality (F) over fishing mortality at MSY (F_{MSY}), and of biomass level against a safe biological limit, and corresponding proportions of all stocks in the sampling frame.

Indicator	Number	Proportion
Stocks with F/F_{MSY} estimate	53	56 %
Stocks with biomass estimate	56	59 %

5 Status across all stocks in 2013

Table 7: Stock status for all stocks in the sampling frame in 2013. Columns refer to stock description, value of the F_{2013}/F_{MSY} ratio (*F ind*), F_{2013} lower than F_{MSY} (*F status*), and whether the stock is inside safe biological limits (*SBL*). Inside safe biological limits means that SSB is greater than Bpa (where Bpa is defined), or F is less than Fpa (where Fpa is defined).

Region	Stock	F ind	F status	SBL
Baltic Sea	Cod in Subdivisions 22-24 (Western Baltic Sea)	3.09		
	Herring in Subdivisions 25 - 29 (excluding Gulf of Riga) and 32	0.47	•	•
	Herring in Subdivision 30 (Bothnian Sea)	0.59	•	•
	Herring in Division IIIa and Subdivisions 22 - 24 (Western Baltic spring spawners)	1.30		
	Herring in Subdivision 28.1 (Gulf of Riga)	0.84	•	•
	Sprat in Subdivisions 22 - 32 (Baltic Sea)	1.20		
Greater North Sea	Cod in Subarea IV (North Sea). Divison VIId (Eastern Channel) and IIIa West (Skagerrak)	2.09		
	Haddock in Subarea IV and Divisions IIIa West and VIa (North Sea. Skagerrak and West of Scotland)	0.52	•	
	Herring in Subarea IV and Divisions IIIa and VIId (North Sea autumn spawners)	0.79	•	•
	Nephrops in Farn Deeps (FU 6)	2.69		•
	Nephrops in Fladen Ground (FU 7)	0.30	•	
	Nephrops in Firth of Forth (FU 8)	0.96	•	•
	Nephrops in Moray Firth (FU 9)	0.49	•	
	Norway Pout in Subarea IV (North Sea) and IIIa (Skagerrak - Kattegat) - Autumn assessment	0.90	•	•
	Northern shrimp (Pandalus borealis) in Divisions IIIa West and IVa East (Skagerrak and Norwegian Deeps)	0.63	•	
	Plaice Subarea IV (North Sea)	0.84	•	•
	Saithe in Subarea IV (North Sea) Division IIIa West (Skagerrak) and Subarea VI (West of Scotland and Rockall)	1.00		
	Sandeel in the Dogger Bank area (SA 1)	1.35		
	Sandeel in the South Eastern North Sea (SA 2)	1.34		
	Sandeel in the Central Eastern North Sea (SA 3)	4.10		
	Sole in Division VIId (Eastern Channel)	1.63		
	Sole in Division VIIe (Western Channel)	0.93	•	•
	Sole in Division IIIa and Subdivisions 22-24 (Skagerrak. Kattegat. and the Belts)	1.29		
	Sole in Subarea IV (North Sea)	1.05		
	Sprat in Subarea IV (North Sea)	0.68	•	
Western European	Black-bellied anglerfish (Lophius budegassa) in Divisions VIIIc and IXa	0.54	•	•
	White anglerfish (Lophius piscatorius) in Divisions VIIIc and IXa	0.95	•	•
	Cod in Divisions VIIe-k (Celtic Sea cod)	1.38		
	Cod in Division VIIa (Irish Sea)	2.88		
	Cod in Division VIa (West of Scotland)	5.21		
	Haddock in Divisions VIIb.c.e-k	2.80		
	Haddock in Division VIb (Rockall)	1.23		
	Herring in Division VIIa South of 52° 30’ N and VIIg.h.j.k (Celtic Sea and South of Ireland)	0.84	•	•
	Herring in Division VIIa North of 52° 30’ N (Irish Sea)	0.93	•	
	Herring in Division VIa (North)	1.07		

Continued on next page

Region	Stock	F ind	F status	SBL
	Hake in Division VIIIc and IXa (Southern stock)	2.45		
	Horse mackerel (Trachurus trachurus) in Division IXa (Southern stock)	0.40	•	•
	Megrim (Lepidorhombus spp.) in Divisions IVa and VIa	1.36		•
	Four-spot megrim (Lepidorhombus boscii) in Divisions VIIIc and IXa	2.11		
	Megrim (Lepidorhombus whiffiagonis) in Divisions VIIIc and IXa	0.78	•	
	Nephrops in North Minch (FU 11)	0.92	•	•
	Nephrops in South Minch (FU 12)	0.66	•	
	Nephrops in the Firth of Clyde (FU 13)	0.90	•	•
	Nephrops in the Sound of Jura (FU 13)	0.19	•	
	Nephrops in Irish Sea East (FU 14)	0.69	•	•
	Nephrops in Irish Sea West (FU 15)	1.17		
	Nephrops on Porcupine Bank (FU 16)	0.52	•	•
	Nephrops on the Aran Grounds (FU 17)	2.16		
	Nephrops off the southeastern and southwestern coasts of Ireland (FU 19)	1.36		•
	Nephrops in the Smalls (FU 22)	0.87	•	
	Plaice in Division VIIe (Western Channel)	1.14		
	Sole in Divisions VIIIa.b (Bay of Biscay)	1.80		
	Sole in Divisions VIIf. g (Celtic Sea)	1.69		
	Sole in Division VIIa (Irish Sea)	1.03		
	Whiting in Division VIIe-k	0.83	•	•
Widely distributed	Blue ling (Molva dypterygia) in Subdivision Vb. and Subareas VI and VII	0.58	•	•
	Herring in Subareas I. II. V and Divisions IVa and XIVa (Norwegian spring-spawning herring)	0.98	•	
	Hake in Division IIIa. Subareas IV. VI and VII and Divisions VIIIa.b.d (Northern stock)	1.56		
	Horse mackerel (Trachurus trachurus) in Divisions IIa. IVa. Vb. VIa. VIIa-c. e-k. VIII (Western stock)	1.35		
	Mackerel in the Northeast Atlantic (combined Southern. Western and North Sea spawning components)	0.87	•	•
	Roundnose grenadier (Coryphaenoides rupenstris) in Subareas VI and VII. and Divisons Vb and XIIb	0.39	•	•
	Blue whiting in Subareas I-IX. XII and XIV (Combined stock)	0.54	•	•

6 Appendix A: Source code

6.1 Data loading and transformation

```
library(dplyr)
library(reshape2)
library(ggplot2)
theme_set(theme_bw())
library(knitr)
opts_chunk$set(echo=FALSE, message=FALSE, warning=FALSE, fig.width=5, fig.height=3, fig.pos=
library(xtable)
# SET UP relative data folder
ddir <- '../data/'

# so = ICES source stock assessment output database
so <- read.csv("../data/ices/20150223/StockAssessmentGraphs_2015223gbjjm1z5bakko2audzwfbskn

# sf = sampling frame
sf <- read.csv("../data/samplingFrame.csv")

# ne = Nephrops data
ne <- read.csv("../data/ices/20150227/nephrops.csv")
# HACK nep-13 to be split in a and b
ne$FishStock <- as.character(ne$FishStock)
ne$FishStock[ne$StockDescription == 'Nephrops in the Firth of Clyde (FU 13)'] <- "nep-13a"
ne$FishStock[ne$StockDescription == 'Nephrops in the Sound of Jura (FU 13)'] <- "nep-13b"

so <- rbind(so, ne)

# add ne
# spp, sppName, FishStock,
sfne <- ne[,c("SpeciesName", "SGName", "FishStock")]
names(sfne) <- c("spp", "sppName", "FishStock")
sfne$category <- 'D'
sfne$shared <- ""
sfne$TACunit <- ""
sfne$sfTACind <- TRUE
sf <- rbind(sf, sfne[c(1,4,5,2,6,3,7)])

# meg
# me* = megrins
meg <- read.csv("../data/ices/20150227/megrin/meg-4a6a.csv")

megdf <- so[1:29,]
megdf[,'FishStock'] <- "meg-4a6a"
megdf$AssessmentKey <- NA
megdf$AssessmentYear <- '2014'
megdf$Year <- meg$Year
megdf$StockDescription <- "Megrim (Lepidorhombus spp.) in Divisions IVa and VIa"
megdf$SpeciesName <- "Lepidorhombus"
```

```r
megdf$SGName <- "Megrims"
megdf$"Report" <- "http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2014/2014/meg-4

megdf[,c("Low_Recruitment", "Recruitment", "High_Recruitment", "Low_TBiomass", "High_TBiomas
megdf[,c("UnitOfRecruitment")] <- 'NA'

megdf[,"TBiomass"] <- meg$Biomass
megdf[,"Landings"] <- meg$Landings
megdf[,"Catches"] <- meg$Catch
megdf[,"Discards"] <- meg$Discards

##
#megdf[,c("IBC", "Unallocated_Removals", "YieldSSB", "Low_F", "F", "High_F", "F_Landings",

so <- rbind(so, megdf)

# sf3 = sampling frame w/TAC
sf3 <- sf[sf$sfTACind,]
sf3 <- unique(sf3[,c("FishStock","sfTACind","category","shared")])

# sr = stock regions
sr <- read.csv("../data/stocksRegions.csv")

# qa = with quantitative advice
qa <- read.csv("../data/qa.csv")
# EUwaters = ecoregions
EUwaters <- c("Baltic Sea Ecoregion",
    "Bay of Biscay and the Iberian Coast Ecoregion",
    "Celtic Seas Ecoregion", "Greater North Sea Ecoregion",
    "Widely distributed and migratory stocks", "Western European Waters")
# sampling frame for ToR 3: stock to be used for TAC indicator
sfTACind.n <- sum(sf3$sfTACind)
so <- merge(so, sf3, all=TRUE)
so$sfTACind[is.na(so$sfTACind)] <- FALSE

# Blim as Bref if Bpa doesn't exist
so$Bref <- so$Blim
so$Bref[!is.na(so$Bpa)] <- so$Bpa[!is.na(so$Bpa)]

# regions (merge BoB with CS) + external sfFind (by ken)
so <- merge(so, sr[,c("FishStock", "ICES.Book", "eurelevant")], all=TRUE)
so$reg <- as.character(so$ICES.Book)
so$reg[so$reg %in% c("Celtic Seas Ecoregion",
    "Bay of Biscay and the Iberian Coast Ecoregion",
    "Bay of Biscay and Iberian Sea")] <- "Western European Waters"

# escapement strategy
so <- merge(so, qa[,c("FishStock", "escapement")], all=TRUE)
so$escapement[is.na(so$escapement)] <- FALSE

# SUBSET
```

```
sa <- select(so, Year, FishStock, Landings, Catches, Discards, SSB, F, Bref,
    FMSY, sfTACind, reg, escapement, eurelevant, TypeStock)
names(sa) <- c("y","stk","L", "C", "D", "SSB","F","Bref","Fref", "sfTACind",
    "reg", "escapement", "eurelevant", "type")

# COMPUTE F/Fref | year + FishStock
sa <- mutate(sa, indF = F / Fref, indB=SSB/Bref)

# ADD meg ratios
sa[sa$stk == "meg-4a6a",'F'] <- meg$F.FMSY
sa[sa$stk == "meg-4a6a",'Fref'] <- 1

sa[sa$stk == "meg-4a6a",'SSB'] <- meg$B.BMSY
sa[sa$stk == "meg-4a6a",'Bref'] <- 1

sa$indF[is.infinite(sa$indF)] <- NA
sa$indB[is.infinite(sa$indB)] <- NA

# in case of escapement strategy MSY evaluated by SSB ~ Blim/Bpa/etc
sa$indF[sa$escapement] <- sa$Bref[sa$escapement]/sa$SSB[sa$escapement]

# COMPUTE SBL | year + FishStock
sa$SBL <- apply(sa,1, function(x)
    !as.logical(sum(x["F"] > x["Fref"] | x["SSB"] < x["Bref"], na.rm=TRUE)))

# if both are NA SBL must be NA
sa$SBL[is.na(sa$indF) & is.na(sa$indB)] <- NA
# ToR 1.a (id quantitative assessments as those stocks that have F
# and Fmsy estimates in 2013 and not relative)
df0 <- subset(sa, y==2013)[,c("stk", "indF", "type")]
df0 <- transform(df0, qa = indF>0 & type!="Relative")
df0$qa[is.na(df0$qa)] <- FALSE
sa <- merge(sa, df0[,c("stk", "qa")])

# ToR 1.b (add to external definition those stocks that are relevant to the EU, external fi
sa <- transform(sa, eurelevant = as.logical(eurelevant))

# Find sampling frame
v0 <- with(sa, qa & eurelevant)
v0[is.na(v0)] <- FALSE
sa$sfFind <- v0

# remove some stocks
# cod-2532, FMSY estimate not used for advice
# nep-32:
# Nop-34-june: keep october SA
sa$sfFind[sa$stk %in% c("nep-32", "Nop-34-june", "cod-2532")] <- FALSE

# final table
samplingFrames <- unique(sa[,c("stk","sfTACind","sfFind")])
```

6.2 ToR 1

```
ggplot(sa[sa$sfFind,] %>% group_by(year=y) %>% summarise(stk=length(stk)),
    aes(x=year, y=stk)) + geom_line() + ylab("No. of stocks") + xlab("")
```

6.3 ToR 2

```
# remove some stocks and years
sf2 <- with(sa, sfFind & y >= 2003 & y < 2014)
```

6.3.1 ToR 2a

```
fInda <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL', N=sum(indF>1, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(indF>1, na.rm=TRUE)))

fInda$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fInda, Region=='All'), aes(x=year, y=N)) + geom_line() +
    expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
    geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fInda, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
  scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fInda, year > 2002), Region~year, value.var='N'),
  caption = "Number of stocks where fishing mortality ($F$) exceeds fishing mortality at MSY
```

6.3.2 ToR 2b

```
fIndb <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL',
        N=sum(indF<=1, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(indF<=1,
        na.rm=TRUE)))

fIndb$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
```

```
  'Widely distributed'))

ggplot(filter(fIndb, Region=='All'), aes(x=year, y=N)) + geom_line() +
    expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
    geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fIndb, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
  scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fIndb, year > 2002), Region~year, value.var='N'),
  caption = "Number of stocks where fishing mortality ($F$) does not exceed fishing mortalit
```

6.3.3 ToR 2c

```
fIndc <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL',
        N=sum(!SBL, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(!SBL,
        na.rm=TRUE)))

fIndc$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fIndc, Region=='All'), aes(x=year, y=N)) + geom_line() +
    expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
    geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fIndc, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
  scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fIndc, year > 2002), Region~year, value.var='N'),
caption = "Number of stocks outside safe biological limits by region and for the whole ICES
```

6.3.4 ToR 2d

```
fIndd <- rbind_list(
  # find by year
  sa[sf2,] %>% group_by(year=y) %>% summarise(Region='ALL',
        N=sum(SBL, na.rm=TRUE)),
  # find by region
  sa[sf2,] %>% group_by(Region=reg, year=y) %>% summarise(N=sum(SBL,
        na.rm=TRUE)))
```

```
fIndd$Region <- factor(fInda$Region, levels=sort(unique(fInda$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fIndd, Region=='All'), aes(x=year, y=N)) + geom_line() +
    expand_limits(y=0) + geom_point(aes(x=2003, y=N[1])) +
    geom_point(aes(x=2013, y=N[length(N)]), size=2) +
  ylab("No. of stocks") + xlab("") + ylim(c(0,55))
ggplot(filter(fIndd, Region != 'All'), aes(x=year, y=N)) + geom_line() +
  facet_wrap(~Region, scales='free') +
  ylab("No. of stocks") + xlab("") +
  scale_x_continuous(breaks = seq(2003, 2013, length=5)) + ylim(0, NA)
kable(dcast(filter(fIndd, year > 2002), Region~year, value.var='N'),
  caption = "Number of stocks inside safe biological limits by region and for the whole ICES
```

6.3.5 ToR 2e

```
idx <- seq(1, dim(sa)[1]) %in% grep("nep-*", sa$stk, invert=TRUE)
fInde <- rbind_list(
  # find by year
  sa[sf2 & !sa$escapement & idx,] %>% group_by(year=y) %>% summarise(Region='ALL',
    F=mean(indF, na.rm=TRUE)),
  # find by region
  sa[sf2 & !sa$escapement & idx,] %>% group_by(Region=reg,
        year=y) %>% summarise(F=mean(indF, na.rm=TRUE)))

fInde$Region <- factor(fInde$Region, levels=sort(unique(fInde$Region)),
  labels=c('All', 'Baltic Sea', 'Greater North Sea', 'Western European',
  'Widely distributed'))

ggplot(filter(fInde, Region=='All'), aes(x=year, y=F)) + geom_line() +
    expand_limits(y=0) + geom_point(aes(x=2003, y=F[1])) +
    geom_point(aes(x=2013, y=F[length(F)]), size=2) +
  ylab(expression(F/F[MSY])) + xlab("")
ggplot(filter(fInde, Region != 'All'), aes(x=year, y=F)) + geom_line() +
  facet_wrap(~Region) +
  ylab(expression(F/F[MSY])) + xlab("") +
  geom_hline(aes(yintercept=1), linetype=2) +
  scale_x_continuous(breaks = seq(2003, 2013, length=5))
kable(dcast(filter(fInde, year > 2002), Region~year, value.var='F'), digits=2,
  caption = "Arithmetic mean value of the $F/F_{MSY}$ ratio by year and region.")
```

6.4 ToR 3

```
sf3 <- with(sa, sfTACind & y == 2013)

with(sa[sf3,], tapply(indF, y, function(x) sum(!is.na(x))))
```

```r
round(with(sa[sf3,], tapply(indF, y, function(x) sum(!is.na(x))/sfTACind.n)), 2)

with(sa[sf3,], tapply(SBL, y, function(x) sum(!is.na(x))))
round(with(sa[sf3,], tapply(SBL, y, function(x) sum(!is.na(x))/sfTACind.n)), 2)
```

6.5 Stock table

```r
# indF>1, SBL, indF
dat <- sa[sf2,] %>% filter(y==2013) %>% select(c(reg, stk, indF, SBL))

tab <- merge(dat, unique(so[,c(1, 5)]), by.x="stk", by.y='FishStock')
tab$Flim <- ifelse(tab$indF<=1, '$\\bullet$', "")
tab$SBL <- ifelse(tab$SBL, '$\\bullet$', "")
tab <- tab[, c(2,5,3,6,4)]

tab <- tab[order(tab$reg),]
tab[duplicated(tab$reg),'reg'] <- ""
tab$reg <- factor(tab$reg, labels=c('', 'Baltic Sea', 'Greater North Sea', 'Western European
  'Widely distributed'))

names(tab) <- c("Region", "Stock", "F ind", "F status", "SBL")
#tab <- xtable(tab, caption="Stock status for all stocks in the sampling frame in 2013. Col
tab <- xtable(tab)

addtorow          <- list()
addtorow$pos      <- list()
addtorow$pos[[1]] <- c(0)
addtorow$command  <- c(paste("\\hline \n",
                             "\\endhead \n",
                             "\\hline \n",
                             "{\\footnotesize Continued on next page} \n",
                             "\\endfoot \n",
                             "\\endlastfoot \n",sep=""))


print(tab, type='latex', include.rownames=FALSE, floating=FALSE, floating.environment='longt
  tabular.environment="longtable", booktabs=TRUE, sanitize.text.function=function(x){x},
  comment=FALSE, add.to.row = addtorow)
```

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Authors:

STECF members:
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Ad hoc Expert group members:
Casey, J.,Jardim, E., Mosqueira, I., Osio, G.C., Scott, F.

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